

**WHAT IS CLAIMED :**

1           1.       An apparatus for modeling and estimating the characteristics of a  
 2 power amplifier, said apparatus comprising:  
 3                   a predistortion module responsive to an input signal and  
 4 coefficients of a complex polynomial representative of said amplifier by  
 5 generating a predistorted signal;  
 6                   the amplifier responsive to a plurality of time-spaced samples of  
 7 said predistorted signal by generating an output signal; and  
 8                   a polynomial module responsive to a current sample of said output  
 9 signal and to a plurality of time-spaced samples of said predistorted signal by  
 10 generating an update of said coefficients of a complex polynomial representative  
 11 of said amplifier as feedback into said predistortion module.

1           2. The apparatus according to claim 1, wherein said coefficients are  
 2 generated for each of a plurality of delay taps.

1           3. The apparatus according to claim 2, wherein said polynomial module is  
 2 represented by the equation

$$3 \qquad y_n = \sum_{m=0}^{M-1} B_m(\vec{b}_m, x_{n-m})$$

4                   wherein "n" is a time index, wherein  $x_n$  is a current sample  
 5 of said predistorted signal, wherein  $y_n$  is said current sample of said output signal,  
 6 wherein  $B_m(\cdot)$  is a polynomial representation of said amplifier, wherein  $\vec{b}_m$  is a  
 7 vector of said complex polynomial coefficients, and wherein M is an order of  
 8 amplifier memory equal to the number of said plurality of delay taps.

1           4.       The apparatus according to claim 3, wherein said complex  
 2 polynomial includes both even and odd terms.

1           5.       The apparatus according to claim 4, wherein said polynomial  
2 module employs a minimum mean squared error criteria to determine said  
3 polynomial coefficients.

1           6.       A wireless radio frequency communications system including  
2 apparatus for modeling and estimating the characteristics of a power amplifier,  
3 said system comprising:  
4                   a predistortion module responsive to an input signal and  
5 coefficients of a complex polynomial representative of said amplifier by  
6 generating a predistorted signal;  
7                   the amplifier responsive to a plurality of time-spaced samples of  
8 said predistorted signal by generating an output signal; and  
9                   a polynomial module responsive to a current sample of said output  
10 signal and to a plurality of time-spaced samples of said predistorted signal by  
11 generating an update of said coefficients of a complex polynomial representative  
12 of said amplifier as feedback into said predistortion module.

1           7.       The system according to claim 6, wherein said coefficients are  
2 generated for each of a plurality of delay taps.

1           8.       The system according to claim 7, wherein said polynomial module is  
2 represented by the equation

$$3 \qquad y_n = \sum_{m=0}^{M-1} B_m(\vec{b}_m, x_{n-m})$$

4 wherein "n" is a time index, wherein  $x_n$  is a current sample of said predistorted  
5 signal, wherein  $y_n$  is said current sample of said output signal, wherein  $B_m(\cdot)$  is a  
6 polynomial representation of said amplifier, wherein  $\vec{b}_m$  is a vector of said

7 complex polynomial coefficients, and wherein M is an order of amplifier memory  
8 equal to the number of said plurality of delay taps.

1 9. The system according to claim 8, wherein said complex  
2 polynomial includes both even and odd terms.

1 10. The system according to claim 9, wherein said polynomial module  
2 employs a minimum mean squared error criteria to determine said polynomial  
3 coefficients.

1 11. A method for modeling and estimating the characteristics of a  
2 power amplifier, comprising the steps of:  
3 generating a predistorted signal in response to an input signal and  
4 to coefficients of a complex polynomial representative of said amplifier;  
5 amplifying a plurality of time-spaced samples of said predistorted  
6 signal to generate an output signal; and  
7 generating an update of said coefficients of a complex polynomial  
8 representative of said amplifier in response to a current sample of said output  
9 signal and to said plurality of time-spaced samples of said predistorted signal.

1 12. The method according to claim 11, wherein said coefficients are  
2 generated for each of a plurality of delay taps.

1 13. The method according to claim 12, wherein said coefficients  
2 generating step is represented by the equation

$$3 \quad y_n = \sum_{m=0}^{M-1} B_m(\vec{b}_m, x_{n-m})$$

4 wherein "n" is a time index, wherein  $x_n$  is a current sample of said predistorted  
5 signal, wherein  $y_n$  is said current sample of said output signal, wherein  $B_m(\cdot)$  is a  
6 polynomial representation of said amplifier, wherein  $\vec{b}_m$  is a vector of said

7 complex polynomial coefficients, and wherein M is an order of amplifier memory  
8 equal to the number of said plurality of delay taps.

1 14. The method according to claim 13, wherein said complex  
2 polynomial includes both even and odd terms.

1 15. The method according to claim 14, wherein said coefficients  
2 generating step employs a minimum mean squared error criteria to determine said  
3 polynomial coefficients.

1 16. An apparatus for estimating the characteristics of a power  
2 amplifier, said apparatus comprising:

3 a polynomial module responsive to a plurality of time-spaced  
4 samples of a predistorted signal by generating a complex polynomial  
5 representative for each of said plurality of time-spaced samples;

6 said polynomial module responsive to a current sample of an  
7 output from said amplifier by generating an update for coefficients of said  
8 complex polynomial representative of said amplifier.

1 17. The apparatus according to claim 16, wherein said polynomial  
2 module uses a current sample of said predistorted signal and at least one previous  
3 sample of said predistorted signal for characterizing said amplifier.

1 18. The apparatus according to claim 17, wherein said amplifier is  
2 characterized as a summation of said complex polynomial representatives.